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- The Fox River Headwaters Workshop, Photograph by D. Feldkirchner
- Fox River Headwaters Ecosystem Significant Ecological Sites
- State Endangered butterfly, swamp metalmark (*Calephelis muticum*), Photograph by M. Brust

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The Fox River Headwaters Ecosystem: An Ecological Assessment for Conservation Planning

Authors
Andrew Galvin, Anne Forbes, and Drew Feldkirchner

Report Contributors
Craig Anderson, Eric Epstein, Randy Hoffman, and William A. Smith,

FRHE Ecosystem Workshop Planning Team and Participants

Natural Heritage Inventory Program
Bureau of Endangered Resources
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison WI 53707-7921

PUB-ER-804 2002

Acknowledgements

Funding for this project was provided by the Great Lakes Protection Fund and the Endangered Resources Fund. We thank Chuck Ledin, Wisconsin Department of Natural Resources, for facilitating the Great Lakes Protection Fund work.

This project would not have been possible without the joint efforts between DNR staff at the Endangered Resources Program and the Northeast, West Central and South Central Regions. We extend special thanks to the Northeast Region's Upper Fox Basin Team and especially to Tom Nigus for his consistent support and dedication to this project. Thanks to the following DNR regional staff that assisted with the design and coordination of the Fox River Headwaters Workshop:

- Ellen Barth, WDNR-NER
- Linda Hyatt, WDNR-NER
- Becky Isenring, WDNR-WCR
- Greg Moeller, WDNR-NER
- Jill Mrotek, WDNR-NER
- Judi Nigbor, WDNR-NER
- Tom Nigus, WDNR-NER
- Ted Pyrek, WDNR-SCR

We also thank the following individuals that conducted inventory work or provided other support to complete this project:

- Craig Anderson, WDNR-BER
- Julie Bleser, WDNR-BER
- Nancy Cervantes, WDNR-NER
- Andy Clark, WDNR-BER
- Fred Clark, Clark Forestry Inc.
- Tim Cooke, WDNR-BER
- Eric Epstein, WDNR-BER
- Drew Feldkirchner, WDNR-BER
- Anne Forbes, Partners in Place
- Andy Galvin, WDNR-BER
- Dawn Hinebaugh, WDNR-BER
- Randy Hoffman, WDNR-BER
- Terrell Hyde, WDNR-BER
- Chris Klahn, WDNR-NER
- Betty Les, WDNR-BER
- William A. Smith, WDNR-BER
- Jedd Ungrodt, Clark Forestry Inc.

Workshop Participants

Special appreciation is due to the many participants who provided information and/or participated in the Fox River Headwaters Workshop, March 8, 2002. Contributor names and their affiliations are listed in Appendix E.

- David Algrem
- Craig Anderson
- Pat Arndt*
- Kate Barrett
- Ellen Barth
- Richard Bautz*
- Randall Berndt*
- Susan Borkin
- Dr. William Brooks
- Christi Buffington
- Nancy Cervantes*
- Daryl Christensen*
- Andy Clark*
- Fred Clark*
- Jim Congdon
- Tom Eddy*
- Tim Ehlinger*
- Mike Engel*
- Elward Engle*
- Eric Epstein*
- Drew Feldkirchner
- Carrie Fhyte*
- Anne Forbes
- Andy Galvin
- Barry Gilbeck*
- Rod Glaman
- Kim Grveles*
- David Hamel*
- Shelly Hamel*
- Bettie Harriman*
- Nicole Van Helden*
- Randy Hoffman*
- Linda Hyatt
- Terrell Hyde
- Rebecca Isenring
- Neil Johnson
- Ruth Johnson
- Pat Kaiser
- Darcy Kind*
- Frank Kirschling
- Diane Kitchen*
- Jim Kronschnabel*
- Steve Lenz*
- Betty Les
- Mark Martin*
- Rob McLennan
- Carl Mesman
- Gretchen Miller
- Greg Moeller
- James Motycha*
- Jill Mrotek
- Tom Nigus*
- Don O'Keene*
- Dave Paynter*
- Mike Penning
- Janel Pike
- Rebecca Power
- Steve Prissel
- Scott Provost*
- Ted Pyrek
- Jerry Reetz*
- Jean Romback-Bartels
- Shelly Schaetz
- Dennis Schroeder
- William A. Smith*
- Elizabeth Spencer
- Jim Tomasko*
- Jedd Ungrodt*
- Walter Walker
- Curt Wilson

* Indicate Contributors that provided site information

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Highlights

The Fox River Headwaters Ecosystem, located in the "sand counties" of central Wisconsin, is home to a remarkable variety of high quality natural communities and rare plants and animals. These are situated within the area's landscape of expansive wetlands, productive farm fields, abundant surface waters, diverse forests, and growing human communities. As the sites where these significant ecological resources are located are mapped and studied, the results provide a sort of blueprint to communicate the highest priority needs for conservation planning in the future. Some of the most significant sites are found within the existing boundaries of public properties or are otherwise protected by groups or individuals. However, many others lack adequate long-term protection.

This report presents the results of a one-year assessment of the significant ecological resources of the Fox River Headwaters Ecosystem. It covers what is currently known about the most significant ecological resources to help guide future conservation strategies by public, nonprofit, and private land managers and landowners. The following are highlights of the report:

- **The Significant Ecological Areas Workshop**, the second of its kind, again showed the value of harnessing the collective knowledge of local observers who shared their expertise of the natural environment and commitment to conservation. Thirty-seven individuals provided information on over 192 locations, and over 60 people attended the workshop to discuss the values and conservation needs of each site.

- **A final set of 86 Significant Ecological Sites** are identified. Each Site is placed within one of 4 categories of ecological significance based on current knowledge. Significant Sites are distributed among many community types; however, their overall relative significance relates in large part to their size, buffering from adjacent land uses, and other aspects related to their potential for successful long term protection.

- **Twenty-five of the Significant Ecological Sites meet the criteria for State Natural Areas designation**.

- **Many rare natural communities and plant and animal species** exist in the study area, including some of state and national significance:
  - Karner blue butterfly, listed as endangered by the Federal government
  - Fifteen species (4 plants and 11 animals) listed as endangered by the State of Wisconsin
  - Twenty-three species (8 plants and 14 animals) listed as threatened by the State of Wisconsin
  - 36 natural community types, including 11 of particular significance to the region or state

- **Ecological Restoration Opportunities** are identified for a variety of habitat and natural community types, including grasslands, oak savannas, wetlands, lakes, rivers and streams.

- **Information needs** and data gaps are identified to support effective conservation planning, including inventory recommendations and guidance for Site boundary review.

Introduction

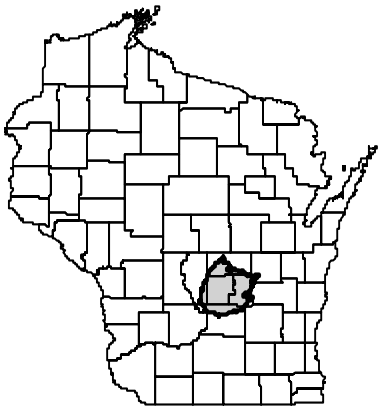

Figure 1. Fox River Headwaters Ecosystem Study Area

One of the fundamentals of conservation planning for any geographic region is an ecological assessment of the sites that are candidates for protection, restoration, or enhancement. This type of assessment for the western portion of the Upper Fox River watershed, known as the Fox River Headwaters Ecosystem (FRHE), is needed by resource planners and citizens to participate in discussions and decisions about future conservation programs and priorities.

Successful, long-term conservation in the FRHE area depends on collaboration between many partners. We hope that many groups and individuals, including local, county, and federal governments; conservation and environmental organizations; and private landowners will use the results of this ecological assessment to communicate and make decisions to conserve the high quality ecological resources in the area.

The FRHE is a geographic area encompassing the upper reaches of the Fox River watershed. The north, west and south boundaries of the study area are outlined by the Fox River watershed. The eastern boundary is the ecological separation between the upper and lower reaches of the larger watershed, here described as the boundary between the Central Sand Hills and the Southeast Glacial Plains ecological landscapes[1]. Within these boundaries, a variety of spring-fed and warm water streams, seepage and drainage lakes, and impoundments converge to form the channel of the circuitous Fox River, as it makes its way from the FRHE area into Lake Butte des Morts then Lake Winnebago and, ultimately, Green Bay. Along the route, expansive wetlands, productive farm fields, and varied forest and woodland types surround this network of surface waters. Scattered throughout the FRHE are many high-quality and rare natural communities, including various types of marshes, fens, wet prairies, and oak barrens that are home to at least 100 species of rare plants and animals that depend on these unique habitats. Some of the state's finest and most popular trout streams originate in the prolific springs that flow out of the western edge of the sand hills. In addition to the high quality and rare habitats that exist, this area offers very good opportunities to protect and restore habitat for the federally endangered Karner blue butterfly.

Although the ecological significance of the FRHE and the opportunities for conservation and restoration have long been appreciated, specific supporting documentation has continued to mount through studies conducted over the past decade. A statewide evaluation of high-quality landscapes rated the White River/Upper Fox River watershed portion of the FRHE high in terms of ecological representation, biological diversity, urgency of threats, and restoration potential (Randy Hoffman, State Natural Areas Program, personal communication). The White River Marsh area also contains the highest quality lowland grassland site in the state (Sample and Mossman 1997). In addition, four of the state's top six potential oak barrens restoration sites occur within the FRHE (Krause 1995). The area is also home to a high concentration of rare natural communities and plant and animal species, including 38 listed as State Threatened or Endangered.

[1] See Appendix A for further explanation of ecoregion boundaries.

This assessment of the FRHE is the result of a year-long effort to gather and summarize existing information on the ecologically important resources in the area, including natural communities, critical habitats, populations of rare plants and animals, and other unique landscape features. The primary impetus for the project was to prepare for an upcoming Wisconsin Department of Natural Resources (WDNR) Feasibility Study that will examine the boundaries of properties currently in state ownership and report on the feasibility of the purchase of new land parcels over 500 acres for State Natural Areas and other conservation and recreation purposes. However, the assessment was also designed to be of value for conservation planning by all types of land managers and landowners, whether their purview is public, nonprofit, or private and to support these conservation efforts for years to come.

This assessment was designed to answer the following basic questions:

- *What are the most significant ecological resources in the area?*
- *Why are they considered significant?*
- *What sites warrant consideration for protection, or improved protection, by the state or other entities?*
- *What additional field inventory or other information is needed to more completely answer the above questions for all potential sites?*

The remainder of this report is divided into these sections:

- The **Ecological Overview** provides a summary of the descriptive aspects of the ecology of the FRHE area, including geology and soils, waters and wetlands, ecological landscapes, vegetation and land cover, currently protected conservation lands, and information on rare species and natural communities from the Natural Heritage Inventory (NHI) database.

- The **Identification of Significant Ecological Sites** presents 86 sites of significance and the methods used to identify them, including:
  1) A Coarse Filter Screening analysis designed to identify potential high-quality natural communities throughout the entire area using GIS and aerial photography.
  2) A compilation of on-the-ground records of actual or potential high quality ecological sites, based on Contributor Records collected from individual scientists, resource managers, conservation enthusiasts, and amateur naturalists.
  3) The results of a workshop where individuals with local knowledge of the area worked in teams to score potential high quality sites, using a set of ecological attributes that indicate the sites' values for conservation efforts.
  4) Analysis and finalization of the Significant Ecological Sites that drew upon all of the above information.

- **Opportunities for Conservation** discusses the current status and significance of the ecological resources of the FRHE area and provides considerations for how this information can be used to support effective conservation planning.

- **Future Information Needs** outlines NHI priorities for future biotic inventory efforts within the FRHE study area based on information submitted for the workshop, current NHI data, and subsequent interpretation.

Ecological Overview

Where is the Fox River Headwaters Ecosystem?

The Fox River Headwaters Ecosystem (FRHE) lies in the western half of the WDNR's Upper Fox Geographic Management Unit (GMU). Its boundaries enclose 823,558 acres or 2.3 percent of the total area of Wisconsin and include parts of these counties: Marquette (296,632 acres), Green Lake (212,801), Waushara (127,468), Columbia (118,128), Adams (53,503), Winnebago (12,023), Fond du Lac (2,302), and Dodge (697).

Resource planners and managers often divide landscapes into geographic areas using different systems of classification for different purposes. A *watershed* is a geographic area with topography that drains to a particular river or lake system. An *ecoregion* is a geographic area that is defined by a relatively consistent pattern of geology, soils, vegetation, natural processes, and climate in addition to topography. For the FHRE, the southern, western, and northern boundaries follow those of the upper Fox River *watershed*. The eastern boundary follows Landtype Associations[2] 222Kd02 (Green Lake Moraines) and 222Kc07 (Redgranite Lake Plain) (see Figures 2 and 3) and represent an eclogical divide between the upper and lower reaches of the larger Fox River basin. The White River Marsh Wildlife Area is an exception to this divide, being located in the Southeast Glacial Plains.

What follows is an introduction to the ecological features of the FRHE, including summary information from the Natural Heritage Inventory (NHI) database on rare natural communities, plants, and animals. More detailed information regarding the ecological features of the FRHE can be found in Appendix A ("Ecological Overview: Background Information on the Fox River Headwaters Ecosystem") and the *State of the Upper Fox River Basin* Report (WDNR 2001).

Geology and Soils

The present-day topography and soils of the FHRE are legacies of Wisconsin's most recent glacial period. During a period lasting from 15,000 to 11,000 years ago, the Green Bay Lobe of the Wisconsin stage of glaciation melted and receded northeast towards present Green Bay. In its wake, it discharged huge volumes of outwash rock, gravel, and sand, leaving a large terminal moraine in the northwest part of the area as well as numerous smaller ground moraines. Giant blocks of ice left behind embedded in the outwash material melted slowly, creating what we now call kettle lakes.

The resulting FRHE is generally low and relatively flat. Bedrock outcrops are rare due to deep layers of sandy soil, typical of Aldo Leopold's aptly named "sand counties" of central Wisconsin. While these soils have been called the "Golden Sands" for their ability to produce high crop yields when irrigated (Hole 1976), they have relatively low moisture-holding capacity and are susceptible to drought.

Waters and Wetlands

The drainage area for the upper Fox River is made up of a number of watersheds (Figure 2). Watersheds present, at least in part, in the FRHE include the Fox River - Rush Lake (UF-05), Fox River - Berlin (UF-

[2] Landtype Associations (LTA's) are part of an ecoregional classification based on the National Hierarchical Framework of Ecological Units (Bailey 1995 and Keys 1995).